

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Christella boydiae*

COMMON NAME: No common name

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION

Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status

New candidate

Continuing candidate

Non-petitioned

Petitioned - Date petition received: May 11, 2004

90-day positive - FR date:

12-month warranted but precluded - FR date: May 11, 2005

Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? Yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

Listing priority change

Former LP:

New LP:

Date when the species first became a Candidate (as currently defined):

October 30, 2001

Candidate removal: Former LP:

A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or

continuance of candidate status.

- U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- F – Range is no longer a U.S. territory.
- I – Insufficient information exists on biological vulnerability and threats to support listing.
- M – Taxon mistakenly included in past notice of review.
- N – Taxon does not meet the Act’s definition of “species.”
- X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Ferns and allies, Thelypteridaceae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Oahu, Maui, and Hawaii

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Oahu and Maui

LAND OWNERSHIP: *Christella boydiae* is known from five populations on Maui, two on Federal land (Haleakala National Park) and three on private land in the Koolau Forest Reserve extending into the Hanawi Natural Area Reserve; and from two populations on Oahu, one on State land (Ewa Forest Reserve), and one population on private land, both in the Kawaihoa Training Area for the U.S. Army in the Koolau mountains.

LEAD REGION CONTACT: Linda Belluomini, (503) 231- 6283, linda_belluomini @fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION

Species Description

Christella boydiae is a small to medium-sized fern with reclining or erect stems and a large, tangled mass of roots that form a holdfast. Fronds are stiffly upright, once-divided, usually 4 to 12 inches (in) (10 to 30 centimeters (cm)) long. Pinnae are lanceolate, 0.8 to 1.4 in (2 to 3.5 cm) long with obtuse tips (Palmer 2003, pp. 87-88).

Taxonomy

Christella boydiae was originally described by Eaton (1879, pp. 361-362). Iwatsuki later moved the species to the genus *Thelypteris* (Iwatsuki 1964; Palmer 2003, pp. 87-88). In 1999, Warren H. Wagner moved the species to *Cyclosorus* and recognized two varieties: var. *kipahuluensis* and var. *boydiae* (Wagner *et al.* 1999a). In his 2003 review of all Hawaiian ferns, Palmer returned the species to *Christella* and did not recognize any varieties (Palmer 2003, pp. 87-88). This is the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History

Typical habitat for this species is exposed, rocky, moss-covered banks of stream courses in dense wet *Metrosideros-Acacia* (ohia-koa) forest, with other ferns, grasses, and dwarfed woody species (Medeiros *et al.* 1993, p. 87).

Historical Range/Distribution

Historically, this species was found on the islands of Oahu, Maui, and Hawaii (Palmer 2003, pp. 87-88). It was known to occur in the Punaluu region of the Koolau mountains on Oahu and in the Kipahulu and Waihoi valleys on Maui (Medeiros *et al.* 1993, pp. 86-87). On the island of Hawaii it was known from bare rocks on the bed of the Wailuku River near Hilo (Hillebrand 1888; Medeiros *et al.* 1993, pp. 86-87).

Current Range/Distribution

Currently, *Christella boydiae* is found only on the islands of Oahu (Koolau mountains) and Maui (Kipahulu, the Koolau Forest Reserve, and Hanawi NAR) (Palmer 2003, pp. 87-88; Hawaii Biodiversity and Mapping Program (HBMP) 2008; H. Oppenheimer, Plant Extinction Prevention Program (PEP), pers. comm. 2008; K. Fay, TNC, in litt. 2010; P. Welton, NPS, pers. comm. 2010).

Population Estimates/Status

Christella boydiae is currently known from seven populations totaling approximately 300 individuals. On Maui, there are five populations, one larger population in Kipahulu Valley of approximately 162 individuals, one population at Palikea stream of 64 individuals, and three populations at east Kopiliula in the Koolau Forest Reserve (extending into the Hanawi NAR) of 43 individuals (P. Welton, , pers. comms. 2008; 2010; H. Oppenheimer, pers. comm. 2008; K. Wood, National Tropical Botanical Garden (NTBG), *in litt.* 2007; HBMP 2008). On Oahu there are two populations, both occurring in the U.S. Army's Kawailoa Training Area in the Koolau mountains. One population of about five individuals is found in the Kawaiiki drainage, and the second population of nine individuals is found along Poamoho stream (Palmer 2003, pp. 87-88; R. Kam, database manager, HBMP, pers. comm. 2008).

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Historical populations of *Christella boydiae* on Oahu have dramatically declined in numbers or disappeared due to man-made stream diversions (Palmer 2003, pp. 87-88).

On Maui, two populations in Haleakala National Park are provided some protection as a result of management of feral pigs (A. Medeiros, pers. comm. 1997); however, the other three Maui populations and the two Oahu populations are not fenced and evidence of pig activity has been reported at all of them (J. Lau, *in litt.* 1993; K. Kawelo, in litt. 2000; K. Wood, *in litt.* 2007).

Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Cook in 1778, with many other introductions thereafter (Tomich 1986, p. 121). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, and are now managed as a game animal by the State to optimize hunting

opportunities (Tomich 1986, p. 125; State of Hawaii 2001). In a study conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui, deleterious effects of feral pig rooting on native forest ecosystems was documented (Diong 1982, 408 pp.). Kipahulu Valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, dominated by *Acacia koa* and *Metrosideros polymorpha*. Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 inches (20 centimeters), greatly disrupting the leaf litter and topsoil layers, and contributing to erosion and changes in ground topography (Diong 1982, pp. 143-150). The feeding habits of pigs were observed to create seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava) (Diong 1982, pp. 164-165). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982, pp. 166-167).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs and other introduced ungulates (Loope *et al.* 1991, p. 3). Because of demonstrated habitat modifications by feral pigs, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants, the Service believes they are threats to *Christella boydiae*.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

None known.

C. Disease or predation.

The two Oahu populations and three Maui populations of *Christella boydiae* are potentially threatened by predation by feral pigs (J. Lau, *in litt.* 1993; K. Kawelo, *in litt.* 2000; K. Wood, *in litt.* 2007). Browsing by ungulates has been observed on many native plant species, including common and rare or endangered species (Cuddihy and Stone 1990, pp. 63-67). Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Merlin and Juvik, p. 597).

Pigs are omnivorous in their diet. In the study described above on feral pig populations in the Kipahulu Valley, pigs were observed browsing on young shoots, leaves and fronds of a wide variety plants, of which over 85 percent were endemic species (Diong 1982, p. 138). A stomach content analysis showed that the pigs' food sources consisted of native plants, 60 percent of which were tree ferns (*Cibotium* spp.), alternating with *Psidium cattleianum* (strawberry guava) when it was available. Pigs were observed to fell plants and remove the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species (herbaceous and woody plants), with larger trees killed over a few months of repeated feeding (Diong 1982, pp. 138, 144).

D. The inadequacy of existing regulatory mechanisms.

Christella boydiae is not currently protected under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pigs are managed in Hawaii as game animals, but many populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990, p. 3). Pig hunting is allowed year-round, or during certain months,

depending on the area (Hawaii Department of Land and Natural Resources 1999, 2003); however, public hunting does not adequately control the number of ungulates to eliminate this threat to native plant species.

E. Other natural or manmade factors affecting its continued existence.

Christella boydiae is threatened by nonnative plant species that degrade and destroy habitat and outcompete native plants (HBMP 2008; Medeiros *et al.* 1993; Palmer 2003). The nonnative plants that are the greatest threat to *C. boydiae* are: *Holcus lanatus* (common velvet grass), *Hypochoeris radicata* (hairy cat's ear), *Prunella vulgaris* (selfheal) at the Kipahulu Valley populations (Medeiros *et al.* 1993); *Clidemia hirta* (Koster's curse), *Tibouchina herbacea* (glorybush), *Prunella vulgaris*, *Rubus rosifolius* (thimbleberry), *Ageratina adenophora* (Maui pamakani), *Paspalum urvillei* (vasey grass), and *Hedychium gardnerianum* (kahili ginger) at the east Kopiliula population (K. Wood, *in litt.* 2007); and *Clidemia hirta* and *Psidium cattleianum* (strawberry guava) at the Kawaiiki population (J. Lau, *in litt.* 1993).

Ageratina adenophora is native to tropical America, and has naturalized in dry to wet forest on the islands of Oahu, Molokai, Lanai, and Maui (Wagner *et al.* 1999, pp. 254-255). Maui pamakani is a shrub 3 to 5 ft (1 to 1.5 m) tall with trailing branches that root on contact with soil. It forms dense mats which prevent regeneration of native plants (Anderson *et al.* 1992, p. 315; University of California 2006). It is considered a serious weed in agriculture, especially in rangeland, because it often replaces more desirable vegetation or native species, and is fatally toxic to horses and most livestock. The eupatorium gall fly, *Procecidochares utilis*, was introduced to Hawaii in 1944 for control of Maui pamakani, and has been successful in suppression of most of the infestations (Bess and Haramoto 1959, p. 248).

Axonopus fissifolius is native to subtropical North America and the Neotropics, where it is commonly used as a pasture grass, and is now widely naturalized in Hawaii in wet pastures and disturbed wet forest and bogs (O'Connor 1999, pp. 1,500-1,503). It is best adapted to the subtropics. This grass forms dense mats with foliage up to 1 ft (30 cm) tall and flowering culms up to 2 ft (60 cm) tall. This species does well in soils with low nitrogen levels, can outcompete other grasses, is not subject to any major diseases or insect pests, and recovers quickly from fire. The seeds are readily spread by water, vehicles, and in the dung of grazing animals (Cook *et al.* 2005).

Clidemia hirta is a noxious shrub first cultivated on Oahu. This pest plant forms a dense understory, shading out native plants and hindering their regeneration, and is considered a serious threat (Wagner *et al.* 1985, p. 41; Smith 1989, p. 189). The most promising biological control to date for Koster's curse is the *Colleotrichum* fungus, *Gloesporioides* f. sp. *clidemiae*, released in 1986. Although there is no quantitative data available, it has an observable negative impact. Other agents tested were a moth (*Antiblemma acclinalis*), a leaf-feeding beetle (*Lius poseidon*), a fruit and flower-feeding insect (*Mompha trithalama*), and a terminal growth-feeding insect (*Liothrips urichi*), all with lesser control success than the fungus (Smith 1989, p. 189).

Hedychium gardnerianum is native to India (Nagata 1999, p. 1,623). This showy ginger was introduced for ornamental purposes, and was first collected in 1954 at Hawaii Volcanoes National Park (Wester 1992, p. 124). Kahili ginger grows over 3.3 ft (1 m) tall in open light

environments, preferring a warm moist climate; however it will readily grow in full shade beneath a forest canopy (Smith 1985, pp. 191-192). It forms vast, dense colonies, displacing other plant species, and reproduces by rhizomes where already established. The conspicuous, fleshy, red seeds are dispersed by fruit-eating birds as well as man. Aircraft-based analysis has found that ginger reduces the amount of nitrogen in the *Metrosideros* forest canopy in Hawaii, a finding subsequently corroborated by ground based sampling (Asner and Vitousek 2005). It may also block stream edges, altering water flow (Global Invasive Species Database 2006a). Kahili ginger can be controlled by herbicides, but biological control is considered the only practical approach for the long-term management of large infestations in native forests. The ability of the bacterium *Ralstonia* (= *Pseudomonas*) *solanacearum* to cause bacterial wilt in Kahili ginger in the field, together with its lack of virulence in other ginger species, contributes to its potential as a biological control agent (Anderson and Gardner 1999, p. 95; Anderson 2003).

Holcus lanatus is native to Europe and naturalized in Hawaii where it occurs on poor, moist soils. Velvet grass is an aggressive weed, growing rapidly from basal shoots or prolific seed and therefore can become dominant if not controlled. Velvet grass gradually forces other plants out, reducing species diversity. Allelopathy may also play a role in the dominance of velvet grass over other grasses (Remison and Snaydon 1980, p. 183). The most effective control measure is physical removal by hand-pulling or hoeing. No effective means of biocontrol have been found (Pitcher and Russon 1988, p. 6).

Hypochoeris radicata is a perennial herb up to 2 ft (3 m) tall, native to Eurasia. In Hawaii it is naturalized in wet and dry disturbed sites on all the main islands (Wagner *et al.* 1999b, p. 327). It has a deep, succulent taproot favored by feral pigs, which dig up large areas searching for the roots (Smith 1985, p. 192). Seeds are produced in large numbers and dispersed by wind. It regenerates rapidly from the crown of the taproot after fire (Smith 1985, p. 192).

Paspalum urvillei is a perennial grass native to the New World, now naturalized in subtropical regions. In Hawaii it is naturalized on all the main islands except Niihau and Kahoolawe, in disturbed mesic areas ranging from 66 to 4,200 ft (20 to 1,280 m) (O'Connor 1999, p. 1,577). Vasey grass forms dense stands which displace native vegetation (Motooka *et al.* 2003).

Pluchea spp. There are two species of *Pluchea* in Hawaii, *P. indica* and *P. carolinensis*, and a cross between them (*Pluchea x fosbergii*). *Pluchea indica* is native to southern Asia, and *P. carolinensis* is native to Mexico, the West Indies, and South America (Wagner *et al.* 1999, pp. 350-351). This 1 to 2 m- (3 to 6 ft) tall, fast-growing shrub, forms thickets in dry habitats and can tolerate saline conditions. It is widespread in Hawaii from coastal areas up to almost 3,000 ft (900 m). The seeds are wind-dispersed (Francis 2006).

Prunella vulgaris is a perennial herb in the mint family, native to North and Central America, temperate Europe, and Asia. In Hawaii, selfheal is naturalized in mesic or wet forest on Molokai, Maui, and Hawaii (Wagner *et al.* 1999b, pp. 828-829). Selfheal is a low-growing plant that spreads easily with its creeping root stocks and by seed (The Green Web 2006). This herb is used medicinally in China and extracts have demonstrated anti-viral properties (Sahelian 2006).

Psidium cattleianum is a tree native to tropical America that has become widely naturalized on all the main islands of Hawaii (Wagner *et al.* 1999, p. 971). Found in mesic to wet forests, strawberry guava develops into dense stands in which few other plants can grow, displacing native vegetation. The fruit is eaten by pigs and birds, which then disperse the seeds throughout the forest (Smith 1985, p. 200; Wagner *et al.* 1999, p. 971). A biological control agent, *Tectococcus ovatus*, has undergone 15 years of testing, and there is a proposal to release this insect at O'laa Forest Reserve on the island of Hawaii (ScienceDaily 2008).

Rubus argutus is native to the central and eastern United States, and naturalizes in a variety of disturbed habitats (Tunison 1991, p. 2). It reproduces both vegetatively and by seed (Tunison 1991, p. 3). *Rubus argutus* was introduced to Hawaii in the late 1800s and was quickly spread by birds (Wagner *et al.* 1999, p. 1,107; Tunison 1991, p. 3). This taxon grows via runners underground, and readily resprouts from them if above ground tissue is treated with herbicide (U.S. Army 2006, p. 2-1-21). Biological controls were introduced (moths, sawfly, and beetle), but the damage to this nonnative species so far has been negligible (Nagata and Markin 1986, p. 53).

Rubus rosifolius is native to Asia and is common in Hawaii in disturbed mesic to wet forest on all of the main islands. It is a sparse shrub, covered with prickles, and has edible red fruit. It invades the understory, forming dense thickets and outcompetes native plant species. It easily reproduces from roots left in the ground, and seeds are spread by feral animals and birds. There is no specific management information for *R. rosifolius*, but techniques used for the control of blackberry *R. fruticosus*, which is a related species, may be applicable (Pacific Island Ecosystems at Risk 2006; Global Invasive Species Database 2006b).

Tibouchina herbacea, a member of the Melastomataceae family, is native to southern Brazil, Uruguay, and Paraguay. In Hawaii, it is naturalized and abundant in disturbed mesic to wet forest on the islands of Hawaii, Maui, and Lanai (Wagner *et al.* 1999a, p. 915). It forms dense thickets, crowding out all other plant species and inhibiting regeneration of native plants (The Nature Conservancy 2003). All members of this genus are legally declared noxious in the state of Hawaii (HAR Title 4, Subtitle 6, Chapter 68). Research is ongoing for biological controls of this species (Smith 1998; The Nature Conservancy 2003, p. 8).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the current total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent are introduced species, and nearly 100 species are pests (Smith 1985, p. 180; Wagner *et al.* 1999b, p. 45). Confirmed personal observations (HBMP 2008) and several studies (Cuddihy and Stone 1990, p. 74; Wood and Perlman 1997, p. 6-7; Robichaux *et al.* 1998, p. 4) indicate nonnative plant species may outcompete native plants similar to *Christella boydiae*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smith 1985, pp. 240-241; Loope and Medeiros 1992, pp. 7-8; Medeiros *et al.* 1992, pp. 23-24; Ellshoff *et al.* 1995, pp. ii, 3-4; Meyer and Florence 1996, p. 778; Medeiros *et al.* 1997, pp. 23-24; Loope *et al.* 2004, p. 1,472). In particular, alien pest plant species degrade habitat by modifying availability of light, altering

soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74; Vitousek *et al.* 1997, pp. 6-10). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to that of *C. boydiae*, the Service believes nonnative plant species are a threat to this species.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Pig exclosures may provide protection for two Maui populations of this species in Kipahulu Valley in Haleakala National Park. Nonnative plants are being controlled within these exclosures as part of the Park's ongoing habitat management (Medeiros *et al.* 1993, p. 89).

This species is represented in an ex situ collection at Lyon Arboretum (N. Sugii, Lyon Arboretum, pers. comm. 2006).

SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral pigs and by competition with nonnative plants, we conclude there is sufficient information to develop a proposed listing rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of *Christella boydiae* due to competition with nonnative plants for space, nutrients, water, air, and light, and by historical stream diversions. Predation by feral pigs is a potential threat to *C. boydiae*. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

- Protect all individuals from feral pigs
- Control nonnative plants
- Conduct field surveys for additional populations in suitable habitat
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species
- Propagate and maintain genetic stock

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8*
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Magnitude:

This species is threatened by feral pigs that degrade and destroy habitat, and by nonnative plants that compete for light and nutrients. Threats to the habitat of *Christella boydiae*, and to individuals of this species, occur throughout its range and are expected to continue or increase without control or eradication. Feral pigs have been fenced out of two of the seven populations and nonnative plants are being controlled at those sites. This species is represented in an ex situ collection. These ongoing conservation efforts for this species will benefit two populations on Maui, but the remaining populations are still impacted by these threats. Long-term monitoring and management will be required to maintain threat free areas.

Immediacy of Threats:

Habitat degradation by feral pigs and competition with nonnative plants are imminent threats because they are ongoing in two of the five known populations. Possible predation by feral ungulates is considered non-imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. *Christella boydiae* does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. Two populations of *C. boydiae* may benefit from ungulate exclosures and weed control conducted by the National Park Service in Haleakala National Park. This species is represented in an ex situ collection. If it becomes apparent that the routine listing process is not sufficient to prevent large

losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *C. boydiae* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING

Much of the information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communication with Arthur Medeiros, USGS-BRD, Joel Lau of the Hawaii Natural Heritage Program in 1995, and Daniel Palmer, pteridologist, in 1995. We incorporated additional new information on this species from information in our files and the most recent reference *Hawaii's Ferns and Fern Allies* by Daniel Palmer (2003). In 2004, the Pacific Island Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife; Joel Lau; Arthur Medeiros; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood of the NTBG. No new information was provided by these individuals and they were not able to clarify the current status of this plant. In 2005, we contacted species experts and Kapua Kawelo, U.S. Army Environmental, provided confirmation of the status of *Christella boydiae* on Oahu. In 2006, new status and range information was provided by Nellie Sugii, Lyon Arboretum. No new information was provided in 2007. New population status information was provided by Hank Oppenheimer, PEP; Ken Wood, NTBG; and, Roy Kam, HBMP database manager, in 2008. In 2009 no new information was received. In 2010, we contacted the species experts listed below, and received new information from Patti Welton, National Park Service.

List all experts contacted:

Name	Date	Affiliation
Agorastos, Nick	02/09/10	Division of Forestry and Wildlife
Anderson, Stephen	02/09/10	National Park Service, Haleakala NP, Maui
Aruch, Sam	02/09/10	private contractor
Bakutis, Ane	02/09/10	Plant Extinction Prevention Program, Molokai
Ball, Donna	02/09/10	U.S. FWS, Partners Program, Hawaii Island
Beavers, Sally	02/09/10	National Park Service, Hawaii Island
Bily, Pat	02/09/10	The Nature Conservancy, Maui
Bio, Kealii	02/09/10	Plant Extinction Prevention Program, Hawaii Island
Brosius, Chris	02/09/10	West Maui Mountains Watershed Partnership
Caraway, Vickie	02/09/10	Hawaii Division of Forestry and Wildlife, Oahu
Ching, Susan	02/09/10	Plant Extinction Prevention Program, Oahu
Cole, Colleen	02/09/10	Three Mountain Alliance
Conry, Paul	02/09/10	Hawaii Department of Land and Natural Resources
Coordinator	02/09/10	East Maui Watershed Partnership
Duvall, Fern	02/09/10	Hawaii Division of Forestry and Wildlife, Maui
Fay, Kerri	02/09/10	The Nature Conservancy, Maui
Garnett, Bill	02/09/10	National Park Service, Kalaupapa, Molokai
Giffin, Jon	02/09/10	The Nature Conservancy, Hawaii Island
Haus, Bill	02/09/10	National Park Service, Haleakala NP, Maui

Higashino, Jennifer	02/09/10	U.S. FWS, Maui
Imada, Clyde	02/09/10	Bishop Museum
Jacobi, Jim	02/09/10	U.S.G.S., Biological Resources Division
Kawakami, Galen	02/09/10	Division of Forestry and Wildlife, Kauai
Kawelo, Kapua	02/09/10	U.S. Army, Environmental Division
Kier, Matt	02/09/10	U.S. Army, Environmental Division
Kiyabu, Brian	02/09/10	Amy Greenwell Botanical Garden
Kraus, Jim	02/09/10	U.S. FWS, Hakalau NWR
Medeiros, Arthur	02/09/10	U.S. Geological Survey
Misaki, Ed	02/09/10	The Nature Conservancy, Molokai
Moriyasu, Patty	02/09/10	Volcano Rare Plant Facility, Hawaii Island
Moses, Wailana	02/09/10	The Nature Conservancy, Molokai
Nakai, Glynnis	02/09/10	U.S. FWS, Refuges, Maui
Oppenheimer, Hank	02/09/10	Plant Extinction Prevention Program, Maui Nui
Palomino, Anna	02/09/10	Olinda Rare Plant Nursery, Maui
Palumbo, David	02/09/10	National Park Service, Haleakala NP, Maui
Pepi, Vanessa	02/09/10	U.S. Navy, Environmental Contractor
Perlman, Steve	02/09/10	National Tropical Botanical Garden
Perry, Lyman	02/09/10	Division of Forestry and Wildlife, Hawaii Island
Plunkett, Bryan	02/09/10	Lanai Forest and Watershed Partnership
Pratt, Linda	02/09/10	U.S.G.S., Biological Resources Division
Purell, Melora	02/09/10	Kohala Watershed Partnership
Seidman, Stephanie	02/09/10	Maui Nui Botanical Garden
Shishido, Glenn	02/09/10	Division of Forestry and Wildlife, Maui
Silbernagle, Mike	02/09/10	U.S. FWS, Refuges, Oahu
Smith, Miranda	02/09/10	Koolau Mountains Watershed Partnership
Starr, Forest	02/09/10	U.S. Geological Survey
Tanaka, Daniel	02/09/10	Puu Kukui Watershed Preserve
Ward, Joe	02/09/10	Puu Kukui Watershed Preserve
Welton, Patti	02/09/10	National Park Service, Haleakala NP, Maui
Wood, Ken	02/09/10	National Tropical Botanical Garden
Wysong, Michael	02/09/10	DLNR Natural Area Reserves, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Endangered (facing a very high risk of extinction in the wild) (Bruegmann and Caraway 2003). *Christella boydiae* is not included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al.* 2005, 722 pp.).

COORDINATION WITH STATES

On February 11, 2010, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. No additional information or comments were received.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

Acting Cecily A. Bohan 5/18/10
Regional Director, Region 1, Fish and Wildlife Service Date

Rowan W. Gould
ACTING
Director, Fish and Wildlife Service October 22, 2010

Concur:

Do not concur: _____ Date: _____
Director, Fish and Wildlife Service

Director's Remarks:

Date of annual review: _____ Date: April 7, 2010
Conducted by: Cheryl Phillipson, Pacific Islands FWO
Biologist, Prelisting and Listing Program

Comments:

PIFWO Review

Reviewed by: Christa Russell Date: April 22, 2010
Prelisting and Listing Program Coordinator

Marilet Zablan Date: _____
Assistant Field Supervisor, Endangered Species Division

Gina Shultz Date: _____
Acting Field Supervisor